

a positioning system capable of positioning the dispenser relative to a localized area on the support with the support having one or more localized areas,

the dispenser adjusted to dispense droplets no greater than 5 nl.

49. The apparatus of claim 48 wherein the polymer is dissolved in the solution.

50. The apparatus of claim 48 wherein the polymer is in the form of a pellet.

51. The apparatus of claim 48 wherein the dispenser and the support contact each other.

52. The apparatus of claim 48 wherein the support further comprises a cover plate.

53. The apparatus of claim 48 wherein the positioning system is capable of positioning the dispenser between 5 microns and 50 microns away from the support.

54. The apparatus of claim 48 wherein the positioning system is capable of positioning the dispenser 10 microns away from the support.

55. The apparatus of claim 48 wherein the droplet fits within a region on the support having a diameter of less than 300 microns.

56. The apparatus of claim 48 wherein the polymer comprises a monomer.

57. The apparatus of claim 56 wherein the monomer comprises a nucleotide or an amino acid.

58. The apparatus of claim 56 wherein the polymer comprises a nucleic acid, oligonucleotide, polynucleotide, peptide, polypeptide, presynthesized polymer, polyurethane, polyester, polycarbonate, polyurea, polyamide, polyethyleneimine, polyacetate, receptor, enzyme, antibody, catalytic polypeptide, hormone receptor, or opiate receptor.

59. The apparatus of claim 56 wherein the polymer comprises at least 2 monomers.

60. The apparatus of claim 56 wherein the polymer comprises greater than 100 monomers.

61. The apparatus of claim 56 wherein the polymer comprises 2, 3, 4, 5, 6, 10, 15, 20, 30, 40, 50, 75, or 100 monomers.

62. The apparatus of claim 48 wherein the support is selected from the group consisting of substantially flat substrates, substrates having raised or depressed regions, beads, gels, sheets, particles, strands, precipitates, spheres, containers, capillaries, pads, slices, films, plates, and slides.

63. The apparatus of claim 48 wherein the support comprises a gel.

64. The apparatus of claim 48 wherein the support comprises biological materials, nonbiological materials, organic materials or inorganic materials.

65. The apparatus of claim 48 wherein the support is a disc, square, or circle.

66. The apparatus of claim 48 wherein the localized area is smaller than 1mm^2 .

67. The apparatus of claim 48 wherein the localized area is smaller than 0.5mm^2 .

68. The apparatus of claim 48 wherein the localized area is smaller than $10,000\text{ }\mu\text{m}^2$.

69. The apparatus of claim 48 wherein the localized area is smaller than $100\text{ }\mu\text{m}^2$.

70. The apparatus of claim 48 wherein the array includes polymers that are at least 5% pure in their respective localized areas.

71. The apparatus of claim 48 wherein the array includes polymers that are at least between 10% and 20% pure in their respective localized areas.

72. The apparatus of claim 48 wherein the array includes polymers that are at least between 80% and 90% pure in their respective localized areas.

73. The apparatus of claim 48 wherein the array includes polymers that are at least greater than 95% pure in their respective localized areas.

74. The apparatus of claim 48 wherein the array includes at least 100 different polymers at different localized areas.

75. The apparatus of claim 48 wherein the array includes at least 1000 different polymers at different localized areas.

76. The apparatus of claim 48 wherein the array includes at least 10,000 different polymers at different localized areas.

77. The apparatus of claim 48 wherein the array includes at least 100,000 different polymers at different localized areas.

78. The apparatus of claim 48 wherein the array includes at least 1,000,000 different polymers at different localized areas.

79. The apparatus of claim 48, wherein the array includes at least 1000 different polymers occupying localized areas within 1 cm² of the surface of the support.

80. The apparatus of claim 48, wherein the support comprises glass, derivatized glass, pyrex, quartz, a polymeric material, polystyrene, polycarbonate, silicon or a gel.

81. The apparatus of claim 48, wherein the solution of the polymer comprises an aqueous solution.

82. The apparatus of claim 48 wherein the apparatus includes a plurality of dispensers.

83. The apparatus of claim 48, wherein the support bears at least two reference points for positioning the dispenser over at least one of said localized areas for release of said droplet.

84. The apparatus of claim 83, wherein the reference points comprise global reference points for positioning the dispenser over a local region of the surface of the support, and local reference points within the local region for positioning the dispenser over a localized area within the local region.

85. The apparatus of claim 83, wherein the dispenser further comprises a camera for identifying the reference points.

86. The apparatus of claim 83 further comprising a device for sensing changes in capacitance to identify the reference points.

87. The apparatus of claim 83 further comprising a device for sensing changes in light intensity to identify the reference points.

88. The apparatus of claim 83 further comprising a device for sensing changes in resistivity to identify the reference points.

89. The apparatus of claim 83 further comprising a device for sensing changes in optical properties to identify the reference points.

90. The apparatus of claim 83 further comprising a device for sensing changes in magnetic properties to identify the reference points.

91. The apparatus of claim 82 wherein the plurality of dispensers comprises a manifold of delivery lines.

92. The apparatus of claim 82 wherein the plurality of dispensers comprises an array of pipettes.

93. The apparatus of claim 82 wherein the plurality of dispensers comprises a series of tubes.

94. The apparatus of claim 82 wherein the plurality of dispensers includes control valves.

95. The apparatus of claim 48 wherein the polymer includes a linker molecule.

96. The apparatus of claim 48 wherein the dispenser is moveable relative to the support.

97. The apparatus of claim 48 wherein the support is moveable relative to the dispenser.

98. The apparatus of claim 48 wherein the one or more localized areas are spaced less than 3 mm apart.

99. The apparatus of claim 48 wherein the one or more localized areas are spaced less than between 5 microns and 100 microns apart.

100. The apparatus of claim 48 wherein the one or more localized areas has an angular relation between each localized area of about 1 degree.

101. The apparatus of claim 48 wherein the one or more localized areas has an angular relation between each localized area of about 0.1 degree.

102. The apparatus of claim 48 wherein the support comprises at least 100 localized areas.

103. The apparatus of claim 48 wherein the support comprises at least 1000 localized areas.

104. The apparatus of claim 48 wherein the support comprises at least 10,000 localized areas.

105. The apparatus of claim 48 wherein the support comprises at least 1000 localized areas per cm^2 of surface of substrate.

106. The apparatus of claim 48 wherein the support comprises at least 10,000 localized areas per cm^2 of surface of substrate.

107. The apparatus of claim 48 wherein the support comprises a strand including one or more of glass, derivatized glass, quartz, or a polymeric material.

b1
Contd.
108. The apparatus of claim 48 wherein the dispenser comprises a dispenser tip and a sheath encircling the dispenser tip and rigidly extending a fixed distance beyond the dispenser tip.

109. The apparatus of claim 48 wherein the surface of the support comprises a hydrophilic or hydrophobic substance.

110. The apparatus of claim 48 wherein the surface of the support comprises a photoresist.

111. The apparatus of claim 48 wherein the surface of the support is pretreated.

112. The apparatus of claim 48 wherein the dispenser comprises a pipette.

113. The apparatus of claim 48 wherein the dispenser comprises a capillary tube.

114. The apparatus of claim 48 wherein the dispenser comprises an osmotic pump.

115. The apparatus of claim 48 wherein the dispenser comprises a cell sorter.

116. The apparatus of claim 48, wherein the array includes at least 10,000 different polymers occupying localized areas within 1 cm^2 of the surface of the support.

117. The apparatus of claim 48 wherein the dispenser and the substrate have a common frame of reference.

118. The apparatus of claim 48 wherein the dispenser is coupled to a translational mechanism.

119. The apparatus of claim 118 wherein the translational mechanism moves at a rate of 3 to 10 stops per second.

120. The apparatus of claim 119 wherein the translational mechanism is accurate within 1 μm .

121. The apparatus of claim 118 wherein the translational mechanism includes a closed loop position feedback mechanism.

122. The apparatus of claim 118 wherein the translational mechanism operates with insignificant backlash.

123. The apparatus of claim 118 wherein the translational mechanism is an electro-mechanical mechanism.

124. The apparatus of claim 123 wherein the electro-mechanical mechanism has a greater than 1 μm repeatability relative to reaction region diameter travel distance.

125. The apparatus of claim 48 wherein the dispenser is adjusted to repeatedly dispense droplets no greater than 5 nl to the same or a different localized area.

126. The apparatus of claim 83 including a laser for locating a reference point.

127. A kit for forming an array of substances on a substrate, comprising:
an automated dispenser in fluid communication with a solution of a polymer,
a substrate,
an automated positioning system capable of positioning the dispenser relative to the substrate with the substrate having one or more localized areas, and
the dispenser adjusted to dispense droplets no greater than 5 nl.

128. The kit of claim 127 wherein the positioning system is capable of positioning the dispenser between 5 microns and 50 microns away from the support.

129. The kit of claim 127 wherein the droplet fits within a region on the support having a diameter of less than 300 microns.

130. The kit of claim 127 wherein the polymer comprises a monomer.

131. The kit of claim 127 wherein the monomer comprises a nucleotide or an amino acid.

132. The kit of claim 127 wherein the polymer comprises a nucleic acid, oligonucleotide, polynucleotide, peptide, polypeptide, presynthesized polymer, polyurethane, polyester, polycarbonate, polyurea, polyamide, polyethyleneimine, polyacetate, receptor, enzyme, antibody, catalytic polypeptide, hormone receptor, or opiate receptor.

133. The kit of claim 132 wherein the polymer comprises at least 2 monomers.

134. The kit of claim 132 wherein the polymer comprises greater than 100 monomers.

135. The kit of claim 127 wherein the substrate is selected from the group consisting of substantially flat substrates, substrates having raised or depressed regions, beads, gels, sheets, particles, strands, precipitates, spheres, containers, capillaries, pads, slices, films, plates, and slides.

136. The kit of claim 127 wherein the localized area is smaller than 1mm^2 .

137. The kit of claim 127 wherein the array includes at least 100 different polymers at different localized areas.

138. The kit of claim 127, wherein the array includes at least 1000 different polymers occupying localized areas within 1cm^2 of the surface of the support.

139. The kit of claim 127, wherein the substrate comprises glass, derivatized glass, pyrex, quartz, a polymeric material, polystyrene, polycarbonate, silicon or a gel.

140. The kit of claim 127 further including a plurality of dispensers.

141. The kit of claim 127, wherein the substrate bears at least two reference points for positioning the dispenser over at least one of said localized areas for release of said droplet.

*Pl
Contd.*
142. The kit of claim 141, wherein the reference points comprise global reference points for positioning the dispenser over a local region of the surface of the substrate, and local reference points within the local region for positioning the dispenser over a localized area within the local region.

143. The kit of claim 140 wherein the plurality of dispensers comprises a manifold of delivery lines.

144. The kit of claim 140 wherein the plurality of dispensers comprises an array of pipettes.

145. The kit of claim 140 wherein the plurality of dispensers comprises a series of tubes.

146. The kit of claim 127 wherein the one or more localized areas are spaced less than between 5 microns and 100 microns apart.

147. The kit of claim 127 wherein the substrate comprises at least 100 localized areas.

148. The kit of claim 127 wherein the substrate comprises at least 1000 localized areas per cm² of surface of substrate.

149. The kit of claim 127 wherein the dispenser is coupled to a translational mechanism.